6. The microchannel of claim 1 wherein the interior microchannel is a complex microchannel.

7. Microchannel apparatus, comprising:

an interior, complex microchannel comprising a microchannel wall;

a contiguous post-assembly coating along a contiguous length of at least 1 cm of the microchannel wall;

wherein the contiguous post-assembly coating has a contiguous length of at least 1 cm that has an average thickness (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm and wherein at least 90% of the contiguous length of coating is within +/−20% of the average thickness.

8. A method of making the microchannel apparatus of claim 7, wherein the apparatus comprises an integral, leak-free manifold that connects at least 2 parallel interior microchannels, and further comprising passing aluminum-containing compounds through the leak-free manifold and into the at least 2 parallel microchannels and forming a uniform aluminide coating in the at least 2 parallel interior microchannels.

9. Microchannel apparatus, comprising:

an interior microchannel comprising a microchannel wall;

a contiguous post-assembly alumina coating along a contiguous length of at least 1 cm of the microchannel wall;

wherein the contiguous post-assembly coating has a contiguous length of at least 1 cm that has an average thickness (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm and wherein at least 90% of the contiguous length of coating is within +/−20% of the average thickness.

10. Microchannel apparatus, comprising:

a plurality of parallel interior microchannels sharing a common manifold;

wherein each microchannel comprises a metallic wall;

a contiguous post-assembly coating along a contiguous length of at least 1 cm of the metallic wall of at least 90% of the microchannels in the plurality of microchannels;

wherein the contiguous post-assembly coating has a contiguous length of at least 1 cm that has an average thickness (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm and wherein the contiguous post-assembly coating in each of the microchannels in the at least 90% of the microchannels in the plurality of microchannels has a length and coating loading that is within +/−20% of the average length and coating loading for the plurality of parallel interior microchannels sharing a common manifold.

11. Microchannel apparatus, comprising:

a plurality of parallel interior microchannels sharing a common manifold;

wherein each microchannel of the plurality of parallel interior microchannels comprises a microchannel wall; and

a contiguous post-assembly coating along a channel length of at least 5 cm of the microchannel wall of at least 90% of the microchannels in the plurality of microchannels wherein the post-assembly coating has a first average thickness over the first 20% in axial length of the contiguous post-assembly coating (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm, and a second average thickness over the last 20% in axial length of the contiguous post-assembly coating (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm, wherein the first 20% of the contiguous post-assembly coating and the last 20% of the contiguous post-assembly coating have coating loadings that are within 20% of each other in the at least 90% of the microchannels in the plurality of microchannels of parallel interior microchannels sharing a common manifold.

12. The microchannel apparatus of claim 11 wherein the contiguous post-assembly coating is a washcoating; and further comprising capillary features disposed under the the last 20% of the contiguous post-assembly coating.

13. A method of making the apparatus of claim 12, comprising:

orienting the apparatus of claim 12 so that, with respect to gravity, the capillary features are higher than a section of the plurality of microchannels that do not have capillary features, and

adding a washcoating liquid to the microchannel and contacting the capillary features; and

draining the washcoating liquid from the microchannel.

14. A method of applying a washcoat onto a microchannel wall, comprising:

providing a microchannel apparatus comprising a microchannel defined by at least one microchannel wall, wherein the at least one microchannel wall comprises capillary features;

adding a washcoating liquid to the microchannel and contacting the capillary features; and

draining the washcoating liquid from the microchannel.

15. A method of washcoating a microchannel device, comprising:

adding a liquid coating composition into a plurality of parallel interior microchannels sharing a common manifold;

draining the liquid from the plurality of parallel interior microchannels sharing a common manifold; and further comprising at least one step of:

(a) wicking liquid out from the plurality of parallel interior microchannels sharing a common manifold;

(b) removing liquid from the plurality of parallel interior microchannels sharing a common manifold with a purging of gas flow that is of sufficiently low flow so that flow through any microchannel in the plurality of parallel interior microchannels sharing a common